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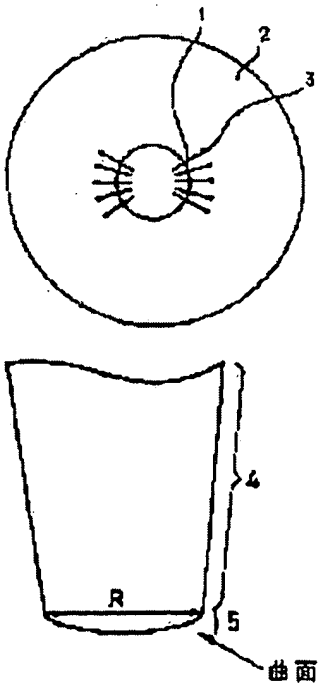
(54) PROBE CARD FOR SEMICONDUCTOR ELEMENT CHECK

(57)Abstract:

PURPOSE: To prevent fusion and adhesion of Sn on a probe pin and eliminate the production of false failure by forming a ridge part where the edge face and the side of the probe pin intersect as a curved surface and letting its radius of curvature satisfy a specific formula.

CONSTITUTION: The edge face and the side of a probe pin 1 is formed of a curved surface. In addition, the edge shape of the probe pin 1 is substantially a spherical curved surface, and a probe card 2 whose radius (r) of curvature statisfies the pelation $0.5R \leq r \leq 5R$ is recommeded. However, R is the diameter of the tip of the probe pin 1 and indicates the diameter of a truncated cone part 4 at the boundary position of the trancated cone part 4 and a spherical face part 5. Furthermore, the tip part of the probe pin 1 a part on which at least the probe pin and an electrode pad are brought into contact with each other may be formed of the curved face. Maximum roughness



2μm or less on the curved face is recommeded to be controlled, and if an electrolytic method is used, curved face machining of the edge part is easy.

LEGAL STATUS

[Date of request for examination]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the approximate account Fig. of a probe card, and (a) is a top view and (b) is a side elevation.
[Drawing 2] It is drawing showing the point configuration of the conventional probe pin.
[Drawing 3] It is the approximate account Fig. showing the probe pin tip configuration of the probe card concerning this invention with drawing of longitudinal section.
[Drawing 4] It is the approximate account Fig. showing the probe pin tip configuration of the probe card concerning this invention with drawing of longitudinal section.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the probe card used for inspection of the electrical characteristics of a semiconductor device.
[0002]
[Description of the Prior Art] Although there are various methods, such as a flat package (FP) and a tape career package (TCP), in the package of a semiconductor device, also in which package, an internal circuitry and an external circuit are connected through the electrode pad prepared in the lead section. Therefore, in order to secure the junction nature in the case of wiring, Sn plating processing or soldering processing is beforehand performed to the above-mentioned electrode pad, and Sn content enveloping layer is formed in it.
[0003] In inspecting the electrical characteristics of said semiconductor device, the probe card with which two or more probe pins were arranged is used, and it is constituted by the appearance from which a flow of a semiconductor device and a circuit tester is obtained by carrying out the pressure welding of the above-mentioned probe pin to said electrode pad. As the above-mentioned probe card, the probe card as shown in (a) of drawing 1 and (b) is indicated by JP,1-128535,A. (a) of drawing 1 is the top view of a probe card, (b) is the side elevation of a probe card, a probe pin and 2 show a card substrate and 3 shows [1] the probe pin attachment section, respectively. In addition, soldering processing is made in the above-mentioned probe pin attachment section, and the probe pin 1 has fixed to the card substrate 2. Although W excellent in high temperature strength etc. is used as the quality of the material of the above-mentioned probe pin, aiming at improvement in pewter wettability of W is also known by using the alloy which added several% of elements, such as nickel, Co, and Fe, to W.
[0004] However, Sn which originates in Sn content enveloping layer of an electrode pad as the count of a test will increase, if it inspects using the above probe pins welded at the tip of a probe pin, and Sn oxide was formed, and the contact resistance between a probe pin and an electrode pad became large, false [which also judges ****** soon to be a defective / poor] occurred, and it had the problem that the stable inspection result was no longer obtained.
[0005] In addition, although inspection of the electrical characteristics of a semiconductor device is generally conducted as one process of a continuation production line, if false [poor] occurs by inspecting using the above-mentioned probe pin, while a product yield will fall, the problem of also reducing the operating ratio of a continuation production line is caused.
[0006]
[Problem(s) to be Solved by the Invention] This invention tends to be made paying attention to the above-mentioned situation, tends to prevent joining of Sn to a probe pin, and tends to offer the probe card which false [poor] does not generate.
[0007]
[Means for Solving the Problem] This invention which solved the above-mentioned technical problem is a probe card used in case it has two or more probe pins and the electrical characteristics of a

semiconductor device are inspected or measured, and let it be a summary to form the arris part which the apical surface and side face of the above-mentioned probe pin cross on the curved surface.
[0008] Moreover, the tip configuration of the above-mentioned probe pin is an abbreviation spherical-surface-like curved surface, and the probe card with which the radius of curvature r is satisfied of following the (1) type is also recommended.
0.5R<=r<=5R -- (1)
However, R is the diameter of a tip of a probe pin [0009]. Furthermore, if controlling the maximum granularity in this curved surface to 2 micrometers or less is recommended and it uses an electrolytic decomposition process that the part which a probe pin and an electrode pad contact at least should just be formed in the curved surface, curved-surface processing of the above-mentioned point is easy for the point of said probe pin.
[0010] In addition, since evaluation die length sufficient in the point of a probe pin cannot be taken, surface roughness cannot be measured directly according to JIS. If the surface maximum granularity is the difference (spacing of a bottom of thread line and a crest crest line) of the depth of the deepest trough in the granularity curve obtained using the laser beam microscope, and the height of the greatest crest and criteria die length and evaluation die length are removed in this invention, it will be the maximum height Ry of JIS (B0601-1994). It corresponds. Moreover, it is the same as that of the case where Ry is calculated to sample the part which shifts and does not have a high crest and a low trough of the average it is considered that is a crack.
[0011]
[Embodiment of the Invention] As a factor which causes Sn joining to a probe pin, the tip configuration of a probe pin, the surface roughness of a point, and the quality of the material of a point are mentioned. Since the include angle a formed on a side face presents a sharp configuration 95-degree order and this part is contacted on the electrode pad section while an apical surface is flat as shown in drawing 2 , if a probe pin, or the location and include angle of a semiconductor device shift somewhat, for example, the case where the touch area at the time of contact becomes very small will generate the tip configuration of the above-mentioned probe pin. If a touch area is small, when the current density energized at the time of inspection becomes high, the temperature of a contact part rises, Sn in a deposit fuses, and it welds at the tip of a probe pin.
[0012] When the surface roughness of a probe pin point is large, it further becomes easy to generate the case where the touch area at the time of contact becomes very small. Moreover, since it inspects pushing the probe card with which two or more probe pins were arranged above a fixed load in case a probe pin apical surface is contacted in the electrode pad section, a probe pin point will slide on the front face of Sn content enveloping layer on an electrode pad. If the surface roughness of a point is large, it is easy to generate adhesion by this sliding, Sn which agglutinated further fuses, and it welds at the tip of a probe pin. On the other hand, as the quality of the material of a point, in containing any one or more sorts of nickel, Co, and the Fe in the base material of W, it turns out that it is easy to generate Sn joining.
[0013] Even if this invention persons were the cases where a probe pin or a semiconductor device shifted somewhat about the tip configuration of a probe pin first based on the above-mentioned knowledge, they resulted in the conclusion that the thing to which the touch area at the time of contact does not become small and for which the curved-surface section is formed at the tip of the above-mentioned probe pin like is important.
[0014] Drawing 3 and drawing 4 are drawings of longitudinal section showing the tip configuration of the probe pin of the probe card concerning this invention, drawing 3 is the example in which the arris part which the apical surface and side face of a probe pin cross was formed on the curved surface, and the tip configuration of drawing 4 of the above-mentioned probe pin is the example with which it is an abbreviation spherical-surface-like curved surface and the radius of curvature r is satisfied of following the (1) type.
0.5R<=r<=5R -- (1)
[0015] However, R is the diameter of a tip of a probe pin, and supposing it divides into the part (henceforth the truncated-cone section 1) which carried out the configuration of a cylinder or a truncated

cone as the point of a probe pin was shown in a detail at drawing 4 , and the part (henceforth the spherical-surface section 5) which consists of a spherical-surface-like curved surface more, it will say the diameter of the above-mentioned truncated-cone section 4 in the boundary location of the truncated-cone section 4 and the spherical-surface section 5.

[0016] Since the diameter of the truncated-cone section 4 and the diameter of the spherical-surface section 5 become the same and the diameter of the truncated-cone section 4 becomes larger than the diameter of the spherical-surface section 5 in the case where it is under 0.5R when the above-mentioned radius of curvature r is 0.5R, formation of a curved surface is substantially difficult. In that by which the above-mentioned radius of curvature r exceeds 5R on the other hand, if a probe pin, or the location and include angle of a semiconductor device shift, the touch area at the time of contact will become very small, and it will be easy to generate poor contact.

[0017] In addition, the crossover include angle formed of both at the time of the pressure welding of the probe pin being carried out to the electrode pad section does not necessarily serve as a perpendicular, but a pressure welding may be carried out after the probe pin has inclined somewhat. What is necessary is just to set it as the range near 0.5R as it is so good that the above-mentioned radius of curvature r is close to 5R and whenever [tilt-angle] becomes large, when whenever [tilt-angle / of this probe pin] (include angle from a vertical position) is small.

[0018] Furthermore, it also turns out that the arris part at a tip may carry out work similar to a cutting tool by the conventional probe pin which has a sharp tip configuration as shown in drawing 2 , Sn content enveloping layer of the electrode pad section may be shaved off, and it becomes the cause of exfoliation of a plating layer, and has a bad influence on the junction nature of the lead for semiconductor devices. For example, even if it is the case where whenever [tilt-angle / of the probe pin at the time of a semiconductor device check] is 1-10 degrees, the field where a probe pin contacts Sn content enveloping layer may attain to even a lateral portion not only exceeding an apical surface but exceeding an arris part by sliding at the time of the pressure welding of the probe pin being carried out to the electrode pad section, and, in such a case, it becomes easy to produce shaving picking of the above-mentioned Sn content enveloping layer. Since shaving picking of Sn content enveloping layer might arise like the conventional probe pin when the radius of curvature r exceeded 5R even if it was the probe pin which formed the apical surface in the shape of the abbreviation spherical surface, in this invention, the upper limit of the above-mentioned radius of curvature r was set as 5R.

[0019] Since the arris part at a tip is formed on the curved surface or the apical surface is formed in the shape of [which is the radius of curvature of the specific range] the abbreviation spherical surface, as the lateral portion of a probe pin contacts Sn content enveloping layer and does not shave off the probe pin concerning this invention, it does not have a bad influence on the junction nature of the lead for semiconductor devices.

[0020] Although this invention does not limit the approach of processing the tip configuration of a probe pin on a curved surface, using an electrolytic decomposition process is recommended. Although it is not easy by the usual grinding method to carry out detailed curved-surface processing whose diameter R of a tip is about 50 micrometers to the probe pin which makes W or W alloy the quality of the material, it becomes easy by performing electrolysis using an alkaline solution to process the above-mentioned configuration.

[0021] As the above-mentioned alkaline solution, in the solution containing alkali-metal hydroxides, such as NaOH and KOH KNO2, KNO3, NaNO2, and calcium (NO2)2 and calcium (NO3)2 etc. -- the nitrate of alkali metal or alkaline earth metal -- or a nitrite [or] An electrolytic condition should just set up suitably solution concentration, solution temperature, electrolytic voltage, electrolysis time amount, etc. according to the target processing configuration that what is necessary is just to use the solution containing (representing and calling it an alkali-metal nitrate hereafter).

[0022] In addition, by setting [whether by the initial stage, the whole point configuration is first processed into the form where the purpose was followed in general, with the application of the comparatively high electrical potential difference, next it can do, and] up an electrical potential difference low, and electrolyzing on conditions [****], electrolytic voltage makes surface roughness of

a point small, and can manufacture a front planar good probe pin.
[0023]

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CLAIMS

[Claim(s)]
[Claim 1] The probe card for a semiconductor device check which is a probe card used in case it has two or more probe pins and the electrical characteristics of a semiconductor device are inspected or measured, and is characterized by forming the arris part which the apical surface and side face of the above-mentioned probe pin cross on the curved surface.
[Claim 2] The probe card for a semiconductor device check which it is the probe card used in case it has two or more probe pins and the electrical characteristics of a semiconductor device are inspected or measured, and the tip configuration of the above-mentioned probe pin is an abbreviation spherical-surface-like curved surface, and is characterized by the radius of curvature r satisfying following the (1) type.
$0.5R<=r<=5R$ -- (1)
However, R is the diameter of a tip of a probe pin [claim 3]. The probe card for a semiconductor device check according to claim 1 or 2 in which the curved surface of the point of said probe pin is formed by the electrolytic decomposition process.
[Claim 4] The probe card for a semiconductor device check according to claim 1 to 3 whose maximum granularity in the curved surface of the point of said probe pin is 2 micrometers or less.

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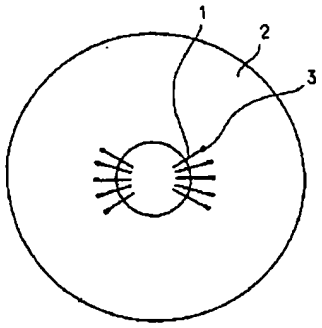
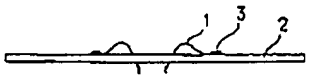
DRAWINGS

[Drawing 1]

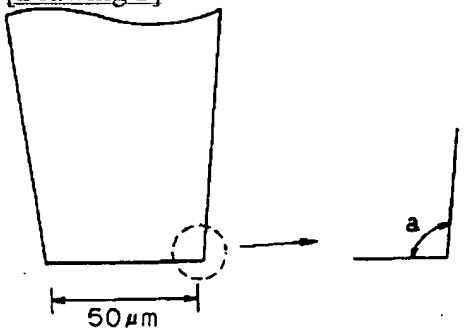
(a)



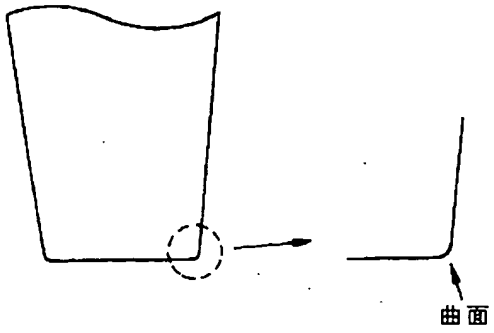
(b)



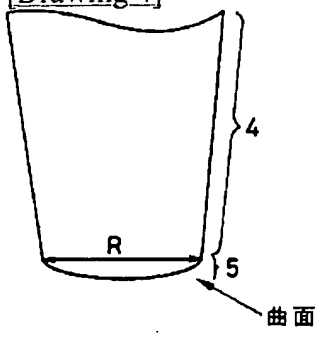
[Drawing 2]



[Drawing 3]



[Drawing 4]



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